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Elżbieta Zakrzewska

Department of Plant Pathology, Plant Breeding and Acclimatization Institute, Radzików, 05–870 Błonie, Poland

REACTION OF MORPHOLOGICAL TYPES OF FABA BEAN TO INFECTION WITH *ASCOCHYTA FABAE* SPEG. AND *BOTRYTIS FABAE* SARD.

ABSTRACT

Reaction of 25 conventional and 63 determinate forms of faba bean to artificial inoculation with *A. fabae* and *B. fabae* was evaluated over five years. The severity of infection of faba bean with *A. fabae* was significantly higher than with *B. fabae*. This was observed for the both morphological types. Most of the conventional forms were less infected than the determinate forms, but it was more distinct for the *A. fabae* infection. Variable resistance reaction of cultivars was observed de–pending on pathogen and growth habit. In all years, conventional as well as determinate cultivars differed significantly in resistance to *A. fabae*. Significant variability of resistance to *B. fabae* was found only in one year for the conventional types and in another year for the determinate types of faba bean. It was found that some determinate cultivars showed higher resistance to *A. fabae* or *B. fabae* than most of the conventional forms, and some conventional forms were in the group of the most susceptible cultivars.

Key words: *Ascochyta fabae*, *Botrytis fabae,* conventional cultivars, determinate cultivars, faba bean, resistance, *Vicia faba* L.,

INTRODUCTION

Faba bean (*Vicia faba* L.) shows high susceptibility to adverse weather conditions. The response of the plant to drought is very nega–tive, particularly during the flowering period, when growth of the vege–tative and generative organs is retarded, flowers are aborted and no pods are set. In years with excessively moist weather growth period of the crop becomes prolonged, setting of pods is late and irregular, which makes the mechanical harvesting difficult. Besides, excessively grown plants tend to lodge, which causes losses in quantity and quality of seed yield. In order to take measures, breeding work on faba bean was di–rected towards production of forms with shorter stature, resistance to lodging and forms early ripening (Heringa 1980). The physiological and morphological requirements of intense production have been met by

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field bean with the determinate growth habit (Fordoński *et al.*, 1989). The first Polish determinate form of field bean was obtained in Radzików (IHAR) in 1974 (Starzycki, Góral 1981). The form, after some improvement, was registered in 1994 as the first Polish determinate cultivar, named Tibo. At present, there are four cultivars of this type in the Polish Register, together with 13 conventional ones.

The fungal diseases are among the most important factors influencing stability of yielding. Release of the new faba bean cultivars with different growth type created a demand for determination of their resistance to the most important pathogens (Jellis 1990).

The *Ascochyta* blight, caused by the fungus *Ascochyta fabae* Speg., and the chocolate spot, caused by the fungus *Botrytis fabae* Sard., are the most frequent diseases of faba bean in Poland and many other countries (Błotnicka 1979, Bernier 1980, Bond and Pope 1980, Filipowicz 1983, Gaunt *et al.* 1978, Sundheim 1973).

Investigation of the field bean resistance to *A. fabae* and *B. fabae*, as well as the breeding of resistant forms, has been carried out in many countries (Ding *et al.* 1993, Hanounik and Malicha 1986, Hanounik and Robertson 1989, Kohpina *et al.* 2000, Lang 1993). The authors inform on occurrence of large variation in the resistance of faba bean to fungal pathogens and about existence of lines resistant to *Ascochyta* blight and chocolate spot diseases. Other papers inform on the resistance of different morphological types of faba bean. Jellis *et al.* (1985) evaluated susceptibility to the *A. fabae* infection among 25 forms of *V. faba* showing differences in stem length and stated high variation in the investigated material. Similarly, Lockwood *et al.* (1985) compared infection level with the same fungus among 30 field bean winter genotypes of the conventional type and three lines of the determinate type with the *ti–1* gene introduced. The authors observed large variation in resistance.

In Poland, the work on faba bean resistance was carried out in the Plant Breeding and Acclimatization Institute in Radzików (IHAR) since 1980 (Zakrzewska, 1985a, 1985b, 1988). A significant variation has been noticed among the cultivars and breeding strains in respect of the resistance to the *Ascochyta* blight. In the studies on infection with *A. fabae* and *B. fabae* in various forms of field bean the plant response proved to be dependent on the pathogen as well as on the morphological type of the plant (Zakrzewska, 1997).

The aim of the presented work was to compare response of conventional and determinate types of Polish faba bean to *A. fabae* and *B. fabae* infections in the conditions of Central Poland, with emphasis on determination of variation ranges in resistance of the both morphological types.

MATERIALS AND METHODS

Plant material

The investigation was carried out in the Department of Plant Pathology of the IHAR in Radzików during five years (1993–1997). The material consisted of 25 conventional and 63 determinate cultivars of faba bean (Table 1). The seed had been delivered by breeders from several Breeding Companies: HR Strzelce, HR Szelejewo, PHR Krzemlin, PHR Sobiejuchy and HR Modzurów. Plants were artificially inoculated with the pathogens under the field conditions of Radzików. In each year, two experiments were carried out for each pathogen: one with the conventional cultivars and the other one with the determinate cultivars. The experiments with *A. fabae* were designed as four randomized blocks and those with *B. fabae* – as three randomized blocks. In the control groups, non–inoculated plants were grown in two replications. In all groups, one replication contained about 50 plants.

Isolation and propagation of fungi

A. fabae was isolated from infected seeds of faba bean to the potato–dextrose–agar medium (PDA). Next, it was maintained and propagated on the MnPDA medium prepared according to the own procedure (Zakrzewska, 1985a): the standard PDA medium was supplemented

Table 1

List of conventional and determinate faba bean cultivars evaluated over five years

No.	1993	1994	1995	1996	1997
	Conventional cultivars				
1.	Nadwiślański	Nadwiślański	Nadwiślański	Nadwiślański	Nadwiślański
2.	Alen	Alen	Alen	Alen	Alen
3.	Bronto	Bronto	Atut	Kamir	Kamir
4.	Gryf	Gryf	Jasny	Kodam	Neptun
5.	Jasny	Jasny	Kamir	Neptun	Redos
6.	Kamir	Kamir	Neptun	Pionier	Tom
7.	Neptun	Neptun	Pionier	Redos	KRC 494
8.	Tom	Stego	Tom	Tom	
9.	KRC 392	Tom	KRC 392	KRC 494	
10.	MOB 190	KRC 392	KRC 494	SOA 594	
11.	SOA 390	AB 6007/85	SOA 594	SOA 695	
12.	SOA 490	Frinebo			
13.	SOA 1368	Sapphire			
14.	SOA 3313				

Table 1

Continued

No	1993	1994	1995	1996	1997
	Determinate cultivars				
1.	Martin	Martin	Martin	Martin	Martin
2.	Optimal	Tinos	Optimal	Optimal	Optimal
3.	Tibo	STH 27	Tim	STH 27	Tim
4.	STH 18	STH 29	Titus	STH 32	KRC 197
5.	STH 23	STH 32	STH 27	STH 39	KRC 243/93
6.	STH 29	STH 33	STH 32	STH 47	KRC 297
7.	STH 33	STH 39	STH 39	STH 55	STH 32
8.	STH 35	STH 42	STH 40	STH 57	STH 57
9.	SZD 28	STH 49	STH 41	STH 62	STH 64
10.	SZD 36	SZD 47	STH 45	STH 64	STH 71
11.	SZD 37	SZD 50	STH 47	SZD 68	STH 78
12.	SZD 41	SZD 63	STH 393	SZD 70	SZD 115
13.	SZD 43	SZD 64	SZD 50	SZD 92	SZD 117
14.	SZD 49	SZD 76	SZD 64	SZD 110	SZD 121
15.	SZD 62	SZD 77	SZD 66	SZD 114	SZD 126
16.	SZD 64	SZD 81	SZD 76	SZD 116	SZD 130
17.	SZD 66	SZD 66	SZD 91		
18.	SZD 791	AB 53/90	SZD 94		
19.		AB 732/88	SZD 791		
20.		Akzent			
21.		Tina			

with some faba bean seed meal (20 g of the meal per 1 l of the medium). The meal was prepared in the following way: seeds of faba bean cv. Nadwiślański were soaked in distilled water during 24 hours in lab conditions. The imbibed seeds were heated in about 90˚C during 30 minutes and the testas were removed. The resulted seed mass was placed in flasks and autoclaved in 121˚C during 30 minutes. Next, it was dried at a temperature between 80˚C and 100˚C and milled. *A. fabae* was transplanted to Petri dishes (10 cm diameter) with the MnPDA medium and incubated in 22˚C, in darkness, for four days. During the next six days of culture the fungus was exposed to the cycles of 12 hours of NUV light and 12 hours of darkness.

B. fabae was prepared in two steps. In the first one, a mycelium was isolated from sclerotia on the faba bean dextrose agar (FDA), which was prepared in the following way: 200 g of field bean seed (cv. Nadwiślański)

were rinsed in tap water and placed into a 2 l flask. Next, 1 l of distilled water was added and the content was autoclaved under pressure of 0.85 atm during 30 min. The resulting brew was filtered through two layers of gauze and complemented to the volume of 1 l (with the distilled water). Next, 39 g of the PDA medium was added, together with 5 g of agar, and the brew was autoclaved again, at 0.25 atm, during 20 min. The sclerotia were sterilized superficially by immersing in 0.5% solution of sodium hypochlorite for 5 min and dried with a sterile blotting paper, before placed into Petri dishes (10 cm of diameter) with the FDA medium. The dishes with sclerotia were kept in a glass case, at room temperature (20–25˚C). After 3–5 days of incubation fragments of the growing mycelia were transferred into new dishes. The mycelia were transplanted several times, until the pure cultures of the pathogen were obtained.

The second step was aimed at production of an abundantly sporulating mycelium. The fungus from pure cultures of *B. fabae* was transplanted to the MnPDA medium (Zakrzewska, 1985a). Dishes with the fungus were arranged in stacks (10 dishes each) and incubated in room temperature, at the natural light access, during 3–5 days, until the mycelia began to grow. Next, the cultures were exposed again to the cycle of 12 hours of NUV light and 12 hours of darkness. After six days of such treatment the dishes with sporulating *B. fabae* were transferred again to a room with natural light, and they remained there for 4–5 days.

Preparation of inoculum, inoculation technique and assessment of infection severity

In the case of *A. fabae*, the inoculation material was produced from 14 days old cultures of the pathogen. The cultures were homogenized together with the medium in distilled water and stored in a fridge (4 – 5˚C) during about 24 hours. The resulting homogenizate of the pathogen culture was mixed mechanically during 30 min. and filtered several times through gauze, in order to remove the mycelium. The pure inoculate of *A. fabae* was adjusted to the concentration of pycnidiospores amounted to 10^6 per 1 ml. Next, Tween 80 surfactant was added and suspension was mixed mechanically during the next 20 minutes. The prepared suspension of *A. fabae* pycnidiospores was used to inoculate the plants.

The inoculation material of *B. fabae* was obtained from 12 days old cultures. The spores were washed out of the dishes with distilled water and after 30 minutes of stirring (with a mechanical mixer) were fil–tered several times through a gauze, in order to remove the mycelium fragments. The resulting suspension of *B. fabae* spores was adjusted to the concentration of 10^5 spores per ml. Next, Tween 80 surfactant was added and suspension was mixed mechanically during 20 minutes. So prepared suspension of *B. fabae* spores was used to inoculate the plants.

For both pathogens, a single inoculation was conducted in a growing season. Plants were sprayed with the spore suspension in the phase of 3 – 5 pairs of leaves. The treatments were performed in the evening hours, when air temperature was close to 20°C and air moisture was relatively high. In the experiments with *B. fabae*, after inoculation, plants were covered with plastic tent for six days.

Observation of plants and analysis of results

The intensity of infection was assessed for each plant using the 9°–scale. The plants with no disease symptoms were scored as 1 and the dying plants were scored as 9. The scorings were performed at different time, depending on the pathogen. In the experiments with *A. fabae* plants were evaluated at harvest and in the experiments with *B. fabae* plants were assessed three weeks after inoculation.

During the growth period, general health status of plants was monitored and the time of each disease emergence and development were recorded. Data on average day temperature and precipitation sum were collected. Weeds were removed manually and pests were controlled with the use of pesticides, according to the recommendations of the Institute of Plant Protection in Poznań.

Statistical analyses were performed with MSUSTAT and STATISTICA packages. Data were analysed separately for years. The following analyses of variance were performed: – separately for morphological types with pathogen as variable, – separately for each pathogen and morphological type within. Goodness of fit of distributions of infection degree of investigated objects to normal distribution was tested with χ^2 test.

RESULTS

The investigation was carried out in five successive vegetation seasons. High differences in weather conditions were observed in three years (Fig. 1 and 2). A particular attention was put on the weather during the period from plant inoculation to full ripeness of pods. June and July were the coldest months in 1993 (bimonthly average 17.8°C), with a relatively low rainfall (85.5 mm). Such low temperatures (17.9°C) were recorded in 1996, but the rainfall was higher (199.4 mm). June and July were the warmest in 1994 and 1995, but the precipitation in these years differed: very low in 1994 (31.1 mm) and high in 1995 (126.4 mm). In 1997, the average temperature of the considered two months was intermediate (18.6°C), but the highest rainfall was recorded (312.0 mm).

In all years plants in control groups were healthy. There were no observed disease symptoms caused by investigated pathogens. The severity of disease symptoms after inoculation with *A. fabae* and *B. fabae* was variable and dependent on the year and pathogen. The analysis of variance was performed with the collected data and the differences were stated in four years in the degrees of infection for both pathogenic fungi.

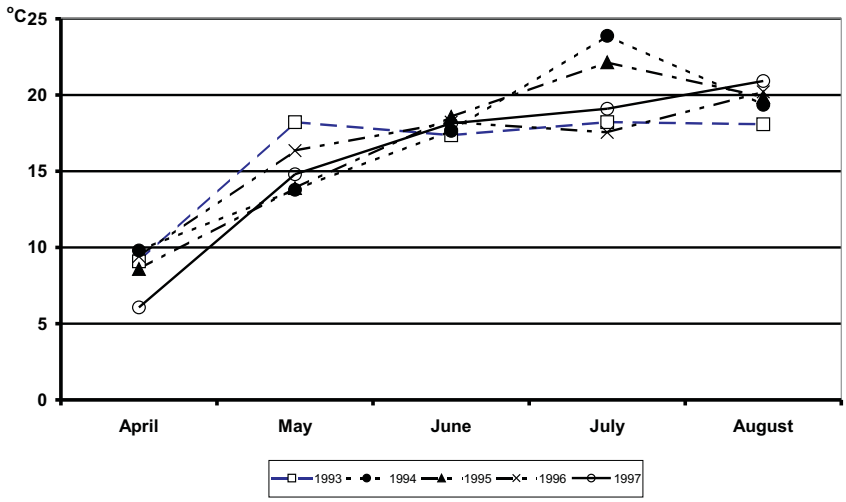

Fig. 1 Daily average temperature for vegetation period of faba bean over five years

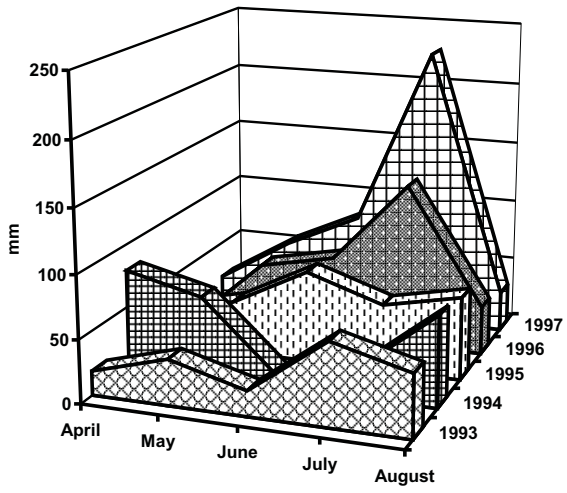

Fig. 2 Rainfall for vegetation period of faba bean over five years

The differences were significant for both the conventional and the determinate forms of faba bean. Only in 1994 the differences in severity of infection could not be proven statistically. Besides, a significant interaction between diseases and cultivars has been stated among the conventional cultivars in four years (except 1994) and among the determinate cultivars in 1996 (Tables 2 and 3). Therefore, the analyses of variance were performed separately for the five experimental years and separately for two morphological types and for two pathogens. The results are shown in the Tables 4 – 7.

Table 2

Comparison of disease severity of faba bean of conventional growth habit inoculated with *Ascochyta fabae* and *Botrytis fabae* under five years

Year	Diseases		Cultivars		Interaction	
	DF	F–value	DF	F–value	DF	F–value
1993	1	54.83**	13	2.18*	13	2.84**
1994	1	0.00	12	3.29**	12	0.76
1995	1	39.50**	10	3.31**	10	3.72**
1996	1	170.97**	10	2.70**	10	3.09**
1997	1	862.84**	6	1.33	6	4.64**

DF – degree of freedom
*, ** Significance at the 0,05, 0,01 probability levels, respectively

Table 3

Comparison of disease severity of faba bean of determinate growth habit inoculated with *Ascochyta fabae* and *Botrytis fabae* under five years

Year	Diseases		Cultivars		Interaction	
	DF	F–value	DF	F–value	DF	F–value
1993	1	531.51**	17	1.95*	17	2.30**
1994	1	3.37	20	2.25**	20	1.84*
1995	1	452.25**	18	1.71*	18	2.30**
1996	1	490.74**	15	1.74*	15	3.53**
1997	1	916.98**	15	0.91	15	1.07

DF – degree of freedom
*, ** Significance at the 0,05, 0,01 probability levels, respectively

In the five years experiments of inoculation with *A. fabae*, the average degree of infection of conventional cultivars ranged from 4.9 (in 1993 and 1994) to 7.3 (in 1997). The respective values for determinate cultivars ranged from 5.2 (in 1994) to 7.8 (in 1997) (Tables 4 and 5). The average infection level of *B. fabae* was less variable in years for both morphological types of faba bean. The extreme values for conventional type were 3.8 (in 1997) and 5.5 (in 1996) and the extreme values for determinate type were 4.3 (in 1993) and 5.7 (in 1996) (Tables 6 and 7).

Table 4

Comparison of disease severity of conventional faba bean cultivars inoculated with *Ascochyta fabae* over five years

Year	No. of cultivars	Disease severity		
		Mean	Range	F–value
1993	14	4.9	4.4 ÷ 5.8	2.32*
1994	13	4.9	4.3 ÷ 5.9	2.08*
1995	11	5.6	4.5 ÷ 6.0	3.35**
1996	11	6.9	6.2 ÷ 7.4	2.55*
1997	7	7.3	6.5 ÷ 7.9	4.25**

*, ** Significance at the 0,05, 0,01 probability levels, respectively

Table 5

Comparison of disease severity of determinate faba bean cultivars inoculated with *Ascochyta fabae* over five years

Year	No. of cultivars	Disease severity		
		Mean	Range	F–value
1993	18	5.8	5.1 ÷ 6.4	2.55**
1994	21	5.2	4.7 ÷ 5.8	2.73**
1995	19	6.3	5.9 ÷ 6.8	2.19**
1996	16	7.2	6.4 ÷ 7.7	1.86*
1997	16	7.8	7.2 ÷ 8.2	3.56**

*, ** Significance at the 0,05, 0,01 probability levels, respectively

The response of faba bean cultivars to the inoculations with fungi was different and dependent on pathogen and plant morphological type. Using the analysis of variance, significant differences in the average infection degree have been proven among conventional and determinant faba bean cultivars in all years of study with *A. fabae*. The intervals between the least and the weakest infection among conventional cultivars were high and amounted 1.4, 1.6, 1.5, 1.2 and 1.4 in the successive years (Table 4). Determinate cultivars, like the conventional ones, have shown a significant differentiation of infection with *A. fabae* in all the years. The intervals between level of infection of the extremely different cultivars in the successive years were: 1.3, 1.0, 0.9, 1.4 and 1.0 (Table 5).

The response of faba bean cultivars to inoculation with *B. fabae* was less intense and less distinct than in the case of *A. fabae*. The interval between the extremal infection degrees of the conventional cultivars was 1.1 in years 1993, 1994 and 1995, 1.7 in 1996 and 0.8 in 1997 (Table 6). For the determinate cultivars the respective values in the successive years were 0.6, 0.8, 0.6, 1.1 and 0.9. The differences between average levels of infection were significant only for the conventional cultivars in 1993 and for the determinate ones in 1996 (Table 7).

Table 6

Comparison of disease severity of conventional faba bean cultivars inoculated with *Botrytis fabae* over five years

Year	No. of cultivars	Disease severity		
		Mean	Range	F–value
1993	14	4.3	3.9 ÷ 5.0	2.30*
1994	13	4.9	4.4 ÷ 5.5	1.04
1995	11	5.0	4.3 ÷ 5.4	1.71
1996	11	5.5	4.7 ÷ 6.4	1.59
1997	7	3.8	3.5 ÷ 4.2	0.69

* Significance at the 0,05 probability level

Table 7

Comparison of disease severity of determinate faba bean cultivars inoculated with *Botrytis fabae* over five years

Year	No. of cultivars	Disease severity		
		Mean	Range	F–value
1993	18	4.3	4.0 ÷ 4.6	1.16
1994	21	5.1	4.7 ÷ 5.5	1.03
1995	19	5.2	4.9 ÷ 5.5	1.01
1996	16	5.7	5.1 ÷ 6.2	5.33**
1997	16	4.8	4.4 ÷ 5.3	1.39

** Significance at the 0,01 probability level

Distributions of infection degree of investigated objects for both pathogens in all years were shown on figures 3 and 4. Critical values of χ^2 test were insignificant for all combinations. It showed that distributions if infection degree with *A. fabae* and *B. fabae* for conventional and determinate faba bean cultivars fitted normal distribution. Shapes of the Gaussian curves were different, depending on the morphological type of the plant. In all years of study the Gaussian curves for the conventional cultivars were flattened while the curves for the determinate ones were more vertical, independently on the pathogen species.

In almost all years, the number of infection severity intervals comprising the characterized cultivars was higher for the traditional forms than for the determinate ones. It was not noted only in the experiments with *A. fabae* in 1996 and with *B. fabae* in 1997 (Figs 3 and 4).

In the experiments with *A. fabae*, majority of the conventional cultivars were less infected than the determinate ones; it was most distinct in the years 1993, 1995 and 1997 (Fig. 3). However, four of the traditional cultivars fell under the category of objects most severely infected by the fungus, together with the determinate cultivars. It concerned the cultivars Bronto in 1993, Stego in 1994, KRC 494 in 1996 and

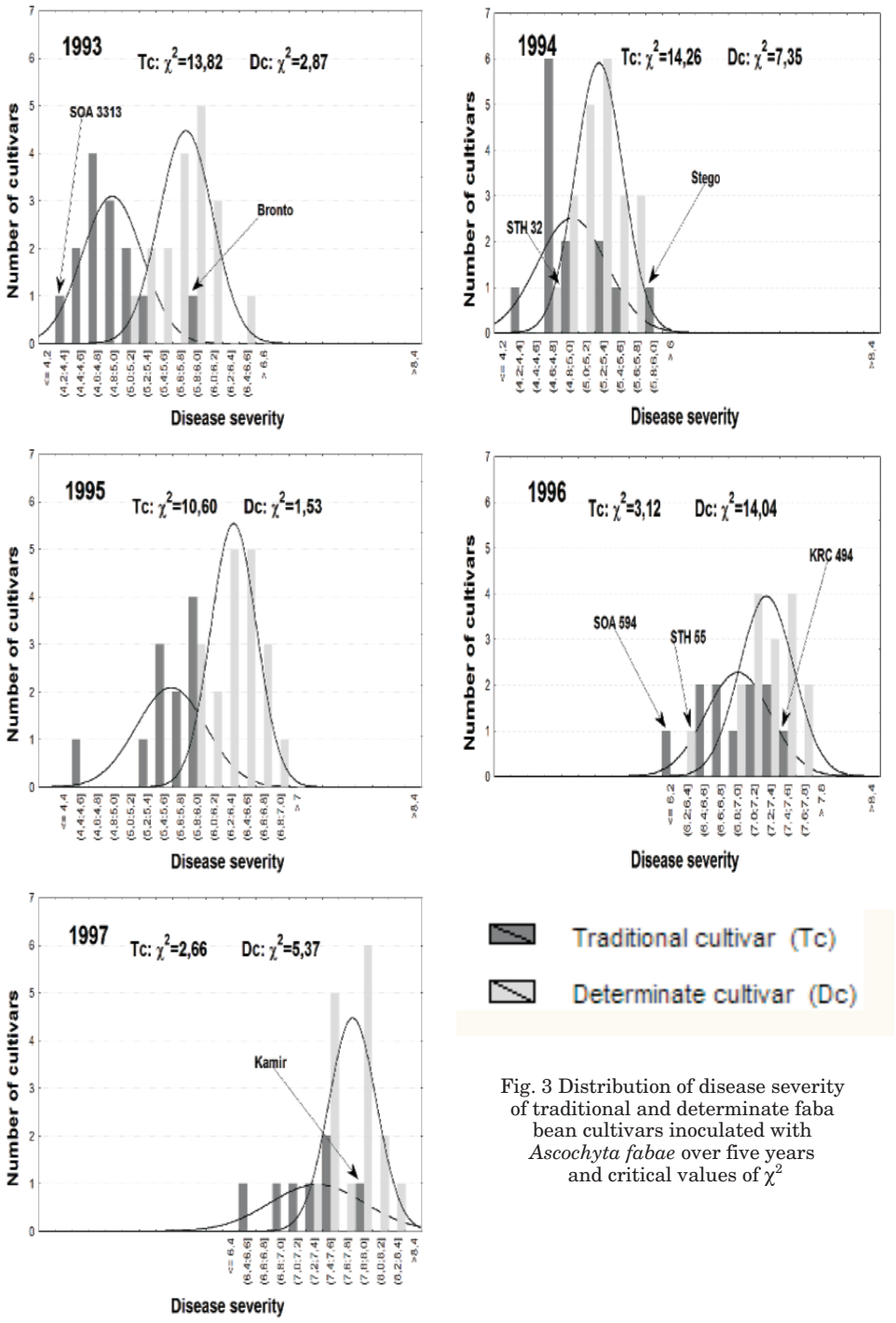

Fig. 3 Distribution of disease severity of traditional and determinate faba bean cultivars inoculated with *Ascochyta fabae* over five years and critical values of χ^2

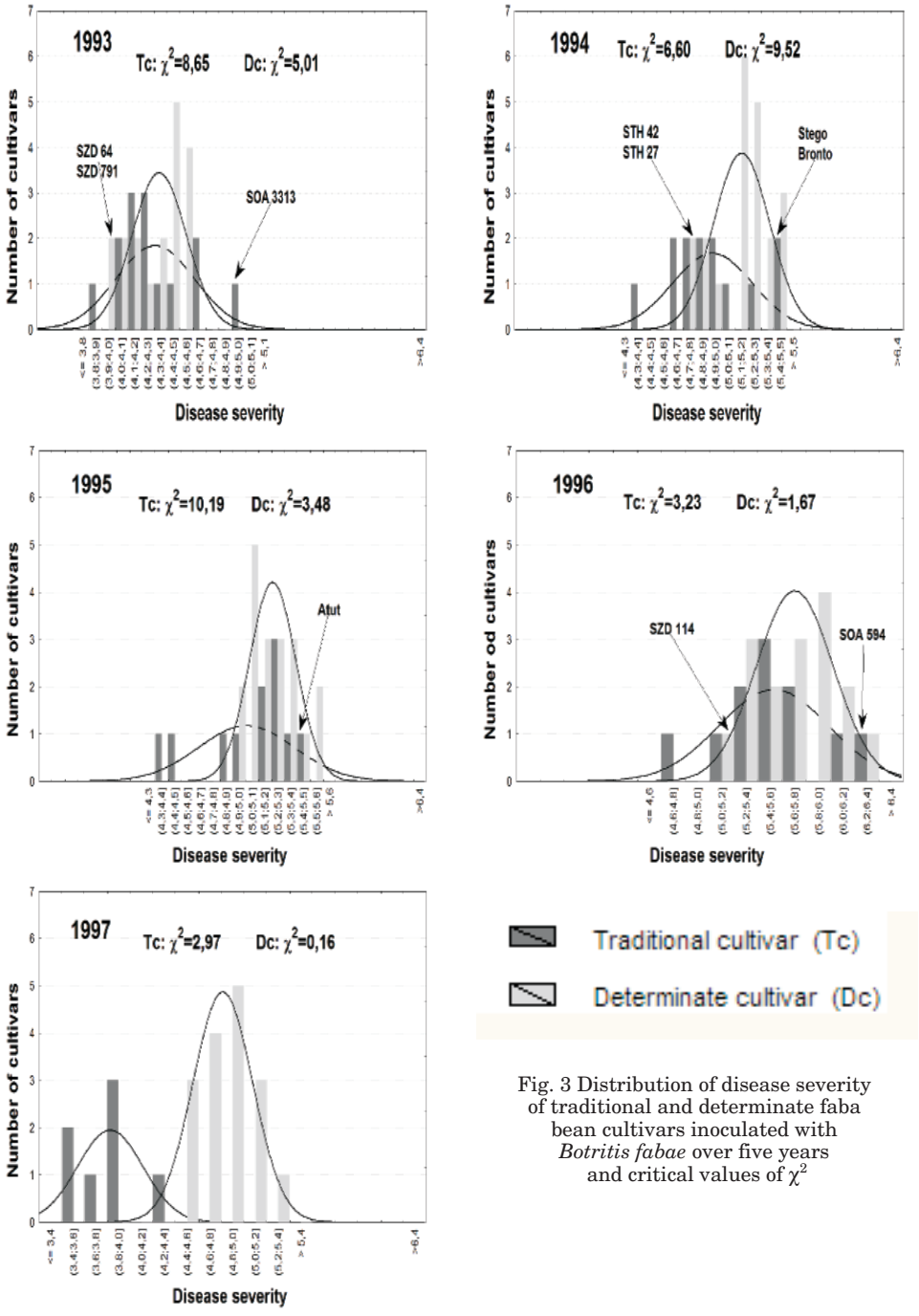

Fig. 3 Distribution of disease severity of traditional and determinate faba bean cultivars inoculated with *Botritis fabae* over five years and critical values of χ^2

Kamir in 1997, whereas two determinate cultivars: STH 32 in 1994 and STH 55 in 1996 reached the class of highest resistance, together with more numerous conventional cultivars (Fig. 3).

In the experiments with *B. fabae* five traditional cultivars were among the most severely infected ones, together with the determinate forms. It concerned SOA 3313 in 1993, Stego and Bronto in 1994, Atut in 1995 and SOA 594 in 1996, while five determinate cultivars were noticed with very weak infection by *B. fabae*, like in many traditional cultivars. It concerned SZD 64 and SZD 791 in 1993, STH 42 and STH 27 in 1994 and SZD 114 in 1996 (Fig. 4).

DISCUSSION

The intensity of *A. fabae* and *B. fabae* infection of faba bean was related to weather conditions in vegetation season. The fungus *B. fabae* thrives at high air humidity, especially when abundant rainfalls are accompanied by higher temperatures. For the development of *A. fabae*, occurrence of rainfalls is particularly important in the period from inoculation to the full ripeness stage. In 1996 and 1997, air temperature in June and July was intermediate and precipitation was very high, so *Ascochyta* blight infection was most intense. The weakest symptoms of the disease were observed in 1993 and 1994, the years of the lowest rainfalls in the critical months. The observed influence of weather on the disease severity is in agreement with the earlier results (Zakrzewska, 1985b).

Analysis of the results revealed an interaction between the pathogens and the cultivars. The response of some faba bean cultivars to the infection with *A. fabae* was reverse to the reaction to the infection with *B. fabae*. Two cultivars: SOA 3313 in 1993 and SOA 594 in 1996 are the best examples of that diverse reaction. In the years mentioned above, the cultivars showed the lowest infection with *Ascochyta* blight and simultaneously they were most severely infected with chocolate spot. The issue of interactions between the pathogens and cultivars requires more profound analysis and will be a subject of a separate study.

The differentiation of faba bean cultivars in respect of disease intensity has been stated in all years of study for *A. fabae* and in some years for *B. fabae*. The obtained results on the differentiation correspond with the earlier own results (Zakrzewska 1985 b, 1988, 1997), as well as with the findings of other authors. Hanounik and Robertson (1989) compared 672 lines of faba bean and stated high variation in respect of *A. fabae* infection. Among the investigated genotypes 19 showed resistance to the pathogen. In another study, Hanounik and Maliha (1986) evaluated the response of 1730 breeding objects of faba bean to the attack of *B. fabae* fungus and distinguished 343 forms as resistant ones. Ding *et al.* (1993) analysed breeding materials of faba bean during five years and found, that 96 forms of 938 showed moderate resistance to *A. fabae* and 94

forms of 910 were moderately resistant to *B. fabae*. Lang (1993) informed, that among 900 assessed field bean genotypes 25 ones were resistant to *Ascochyta* blight and 14 lines were resistant to chocolate spot.

Among the resistant faba bean cultivars the conventional ones were more frequent than the determinate ones, for both *A. fabae* and *B. fabae* pathogens. It has been indicated, that the determinate forms were more severely infected with *A. fabae*, when compared to the conventional ones. At the same time, the differentiation of resistance between cultivars was significant for both morphological types of the plant. The variation among the determinate forms is particularly important for breeding. Two determinate varieties: STH 32 and STH 55 showed the lowest degree of *A. fabae* infection, comparable to the best conventional cultivars (Fig. 3). The determinate cultivar SZD 114 has shown the lowest infection with *B. fabae* (Fig. 4).

Similar results were obtained by Jellis *et al.* (1985) from testing the *A. fabae* resistance of 30 traditional and three determinate faba bean cultivars. They noticed differentiation in infection of pods and high severity of the disease on the determinate forms. The authors concluded, that the phenotypic factors exert significant influence on the resistance of pods to *A. fabae*. However, they emphasized, that the main factor is stem length, which determines height of pods setting and their distribution on stem.

Lockwood *et al.* (1985) investigated the response of faba bean to inoculations with *A. fabae* and found also more severe infections on the determinate forms, in comparison with the traditional ones. The authors noticed that two traditional lines, similar in flowering time and stem length, showed different degree of infection on pods and leaves. The authors suggested that the differences in disease resistance in faba bean are not all attributable to differences in morphology or in ripening time.

In the presented study, the differences of faba bean response to pathogen infection have been proven. The variation stated for the determinate type makes prospects for the breeding activities aimed at production of cultivars, which combine the determinate morphological type with resistance to fungal diseases. The same was suggested by Jellis in his papers (1985, 1990).

REFERENCES

Bernier C. C. 1980. Fungicidal control of *Ascochyta* blight of faba beans. FABIS–Newsletter 2: 43.

Błotnicka K. 1979. Ważniejsze choroby grzybowe bobiku (*Vicia faba minor*) i ich występowanie w Polsce. [The important fungus diseases of *Vicia faba minor* in Poland].Biul. Inst. Hod. i Aklim. Roślin 137: 23–28.

Bond D. A., Pope M. 1980. *Ascochyta fabae* on winter beans (*Vicia faba*): Pathogen spread and variation in host resistance. Plant Pathology. 29. 2: 59–65.

Ding G. Q., Liang X. N., Gan O. F., Luo P. X., Yu D. Z. and Hu R. H. 1993. Evaluation and screening of faba bean germplasm in China. FABIS–Newsletter 32: 8–10.

Filipowicz A. J. 1983. Badania mikoflory nasion bobiku (*Vicia faba* L. var. *minor* Harz.) oraz chorobotwórczości *Ascochyta fabae* Speg. w stosunku do tej rośliny. [Studies on mycoflora of faba bean seeds (*Vicia faba* L. var. *minor* Harz.) and pathogeneticity of *Ascochyta fabae* Speg. on this plant]. Rozprawa habilitacyjna (streszczenie). [Summary of the dissertation]. Wydawnictwo Akademii Rolniczej Lublin: 77.

Fordoński G., Rutkowski M. and Góral M. 1989. Wpływ obsady roślin na plonowanie bobiku o zdeterminowanym i niezdeterminowanym rytmie wzrostu. [Influence of plant sets upon yields of horse bean with determinated and indeterminated growth rate]. Acta Acad. Agricult. Techn. Olst. Agricultura. 49: 151–159.

Gaunt R. E., Teng P. S. and Newton S. D. 1978. The significance of *Ascochyta* leaf and pod spot disease in field beans (*Vicia faba* L.) crops in Cunterbury. Proc. Agron. Soc. N. Z. 8:55–57.

Hanounik S. B., Maliha N. 1986. Horizontal and Vertical Resistance in *Vicia faba* to Chocolate Spot Caused by *Botrytis fabae*. Plant Disease 70: 770–773.

Hanounik S. B., Robertson L. D. 1989. Resistance in *Vicia faba* Germ Plasm to Blight Caused by *Ascochyta fabae*. Plant Disease 73. 8: 202–205.

Heringa R. J. 1980. Faba bean breeding in the Netherlands. FABIS–Newsletter 2: 23–24.

Jellis G. J. 1990. Aspects of disease resistance in field beans (*Vicia faba*). Brighton Crop Protection Conference – Pest and Disease – 1990: 919–923.

Jellis G. J., Lockwood G. and Aubury R. G. 1985. Phenotypic influences on the incidence of infection by *Ascochyta fabae* in spring varieties of faba beans (*Vicia faba*). Plant Pathology. 34: 347–352.

Kohpina S., Knight R. and Stoddard FL. 2000. Evaluating faba beans for resistance to *Ascochyta* blight using detached organs. Australian Journal of Experimental Agriculture. 40. 5: 707–713.

Lang L. J. 1993. Research on Breeding and Germplasm Resources of Autumn–sown Faba bean, 1991/92. FABIS Newsletter 32: 11–14.

Lockwood G., Jellis G. J. and Aubury R. G. 1985. Genotypic influences on the incidence of infection by *Ascochyta fabae* in winter–hardy faba beans (*Vicia faba*). Plant Pathology 34: 341–346.

Starzycki S., Góral M. 1981. Mutant bobiku ze szczytowym kwiatostanem. [Terminal–inflorescence field bean mutant]. Hodowla Roślin Aklimatyzacja i Nasiennictwo 25. 3/4: 77–85.

Sundheim L. 1973. *Botrytis fabae*, B. cinerea and *Ascochyta fabae* on broad bean (*Vicia faba*) in Norway. Acta Agric. Scand. 23. 1: 43–51.

Zakrzewska E. 1985a. Chorobotwórcze oddziaływanie grzyba *Ascochyta fabae* Speg. na rośliny różnych odmian i mutantów *Vicia faba* L. Część I. Niektóre zagadnienia biologii patogena. [Pathogenic effect of the *Ascochyta fabae* Speg. fungus on plants of different varieties and mutants of *Vicia faba* L. Part I. Some problems of biology of the pathogen]. Hodowla Roślin Aklimatyzacja i Nasiennictwo 29. 5/6: 1–22.

Zakrzewska E. 1985b. Reakcja odpornościowa bobiku (*Vicia faba* L. var. *minor* Harz.) i bobu (*Vicia faba* L. var. faba) na porażanie grzybem *Ascochyta fabae* Speg. [Pathogenic action of the fungus *Ascochyta fabae* Speg. on different varieties and mutants of *Vicia faba* L.]. Materiały XXV Sesji Naukowej Instytutu Ochrony Roślin: 295–318.

Zakrzewska E. 1988. Variability in the resistance of *Vicia faba* L. to *Ascochyta fabae* Speg. Hodowla Roślin Aklimatyzacja i Nasiennictwo 32. 1/1: 311–317.

Zakrzewska E. 1997. Study on the influence of *Ascochyta fabae* and *Botrytis fabae* on two growing types of faba bean. Diagnosis and Identification of Plant Pathogens. Developments in Plant Pathology Vol. 11: 539–541.